Austerity through public employment in bad times: exploiting the crowding-out and the competitiveness channels?*

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Abstract

We analyze the impact of public employment and wages' policies on overall labour market outcomes, in particular taking due account of the state of the economy. Labour market channels have not been sufficiently incorporated in current fiscal and financial policy debates, as policy responses have been mainly the outcome of short-run budgetary needs. Nevertheless, the literature has stressed, on the one hand, the "crowding-out" of private employment by public employment and, on the other, the signalling effect of public wages over private sector wages. In addition, these channels may operate differently in recessions and/or high-unemployment situations as compared to normal times. We account for that by means of non-linear STVAR models. We focus on Spanish and euro area aggregate data. The case of Spain is one of a high-unemployment country subject over the past few years to a significant level of "fiscal stress", while the euro area as a whole provides for a medium- to low-unemployment framework, and a moderate level of fiscal stress. Our results show that indeed incorporating differences across regimes is crucial for understanding the labour market impact of public employment and wages' policy actions.

JEL Classification: E62; E65; H6; C3; C82.

Keywords: Public employment; Wages; Unemployment; Fiscal policies.

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1 Introduction

The purpose of this paper is to provide evidence on the impact of current public employment and wages policies on overall labor market outcomes during recession. Taking due account of the state of the economy we provide evidence on how public and private labor markets interaction and, in particular, the reaction of private employment and wages to cuts in public wages and employment, are substantially different during recessions than during expansions.

The literature has begun to explore whether estimates of government spending multipliers vary depending on circumstances, providing abundant pieces of evidence that show that indeed this is the case. This literature has developed in parallel to vivid policy debates around effects of fiscal adjustments and the recession. Labor market channels however have not been sufficiently incorporated in these policy debates given that, to our mind, budgetary considerations (i.e. the need to reduce sizeable public deficits and stabilize mounting levels of public debt) have been the main drivers of decisions leading to public employment and wages' restraint/cuts in a number of EU countries. Labor markets channels are not only absent from the policy debate, but are also poorly represented in the current literature that distinguishes different impact of fiscal policies in recession and expansion.

The theoretical and empirical literature has stressed, on the one hand, the potential crowding-out of private employment by public employment and, on the other hand, the influence signalling/causality effects of public wages over private sector wages. While public sector wages leadership may imply a decoupling of private sector wages from productivity with implications for competitiveness, private sector leadership may imply limited control of the government on the wages it pays, which are determined in the long-term by drivers originating in the private sector.

One could think that if the standard results in the literature on the crowding-out of public employment on private employment were symmetric, public employment cuts due to recent fiscal consolidation measures could have had crowding-in effects on private sector employment in the short-term and might also have medium-run positive effects. Such an outcome of crowing-in could be expected, given: (i) the exerted downward pressure on real wages, (ii) the margin to avoid increases in discretionary taxation; (iii) the margin for increased private

activity in sectors in which government activity retracts. Now, in a situation of economic recession (in bad times) the link between public and private employment might be different from that in normal times, given overall economic weakness. This is precisely one of the issues that this paper investigates. It is likely that in periods of economic hardship wage setting practices in the government sector are affected, but also is affected the interplay between government and private sector wages. It would be interesting to assess whether under conditions of economic distress public sector wage restraint has been instrumental to overall economy wage moderation and as a consequence conductive to a more employment-friendly labour market adjustment than otherwise. The operation of this channel depends crucially on labour market institutions and the relative rigidity/flexibility of wages in the economy (see e.g. Lamo, Pérez and Schuknecht, 2012; Lamo, Pérez and Sánchez-Fuentes, 2013).

In order to ascertain the quantitative relevance of the channels outline above, we carry out an empirical investigation on the basis of quarterly data for Spain and the euro area aggregate. First, we estimate standard SVAR models in which public and private sector labour market variables are allowed to interact. This will be done by bringing together the literature on fiscal SVARs and some labour market literature (see e.g. Pappa, 2005; Linnemann 2009; Lamo, Pérez and Schuknecht, 2012; Ramey, 2012). Then, in order to test the existence of non-trivial non-linearities, we move a step forward and estimate STVAR models nowadays standard in the extant literature - see e.g. the Smooth Transition Structural Vector Autoregression models (STVAR) of Auerbach and Gorodnichenko (2012a, 2012b).[1] With such an approach we aim at capturing the regime-specific labour market linkages among the public and the private sectors.[2]

Focusing on Spain and the euro area is possible due to the availability of quarterly fiscal and macro figures for the periods that start in 1986Q1 and 1980Q1, respectively. We take historical fiscal data from de Castro et al. (2013) in the case of Spain, and from Paredes et al. (2009) for the case of the euro area. Incorporating more EU countries would generally

[1] Applied in the case of Spain by Hernández de Cos and Moral (2013).

[2] STVAR are quite appropriate for the problem at hand, but are not free from critiques, in particular when applied to small- to medium-size samples of data, as discussed for example by Ramey and Zubairy (2013).

restrict the sample to the period starting in 1995 and we believe that the analysis of these two cases provide enough insights for the questions under study. On the one hand, the case of Spain is one of a high-unemployment country that has been subject over the past few years to a significant level of "fiscal stress". on the other hand, the euro area as a whole provides for a medium- to low-unemployment framework, and a moderate level of fiscal stress.

In sum, understanding labor market channels through which fiscal policy operates is of utmost importance to understand the most recent recession, in which some countries have registered unemployment records in parallel to unprecedented episodes of wage restraint and/or employment destruction in the public sector. But labor market channels have not only been of second order of importance in the policy debate, but have also been poorly represented in the recent literature that distinguishes different impact of fiscal policies during recession than during expansion. This paper contributes to filling in that gap in the literature and provides relevant evidence in an attempt to contribute to the policy debate on the effects of restrictive fiscal policies during recession.

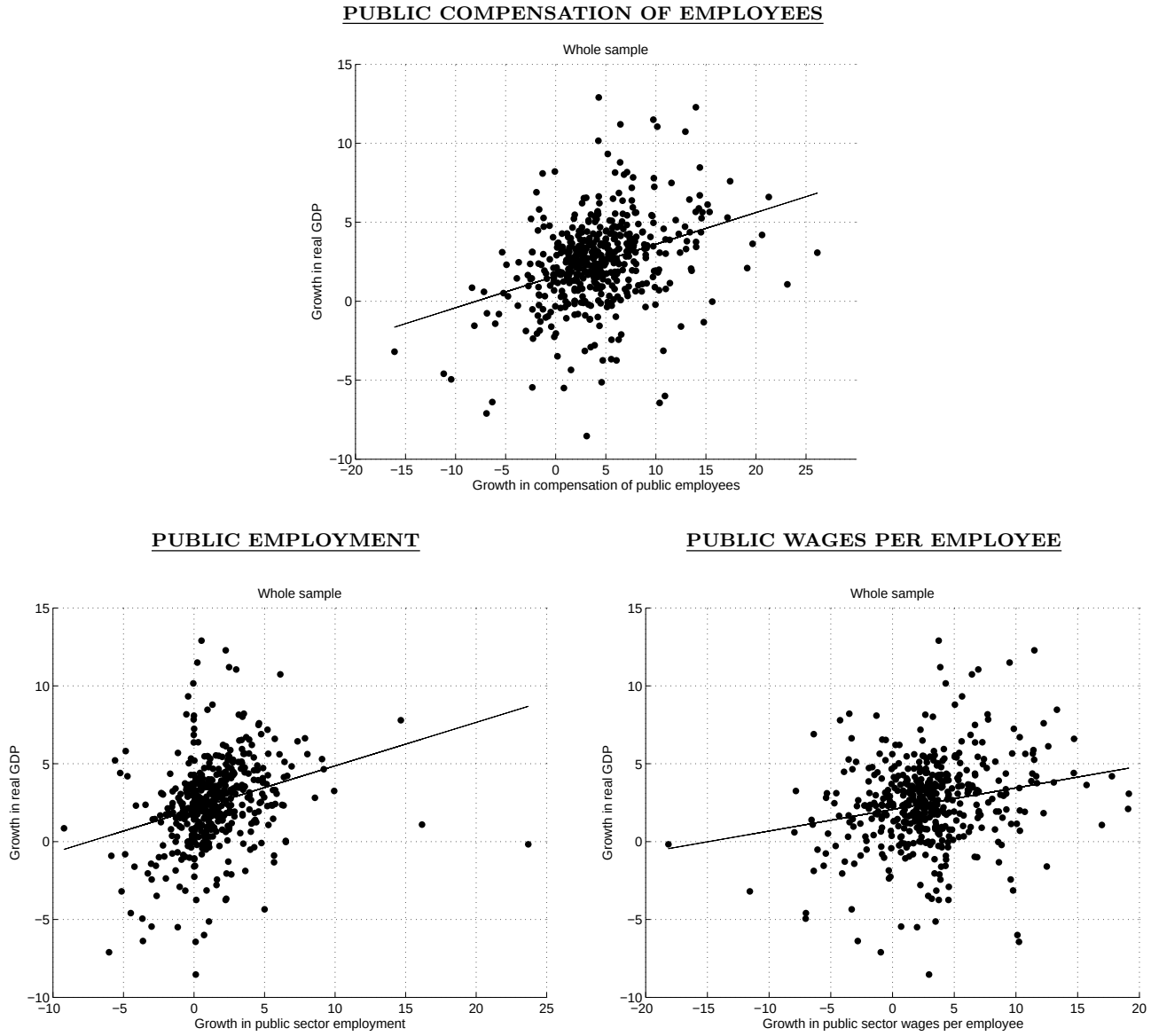
The rest of the paper is organized as follows. In Section 2 we provide some stylized facts to illustrate the main ideas of our paper. In Section 3, in turn, we provide a detailed discussin of the related theoretical and empirical literature, not least to frame the interpretation of our subsequent empirical results. In Section 4 we explain the data used in the study, and also discuss some general issues on public employment data that are of relevance for a study like ours but also from a more general perspective. In Section 5 we present the empirical approach, and in Section 6 we discuss the main results of the paper. Finally, we close the study with Section 7 in which we conclude and provide a discussion of the policy implications of our paper.

2 Some stylized facts

In figures 1, 2, 3, and 4 we show some stylized facts on the evolution of public employment and public wages in the euro area in order to illustrate the ideas put forward in the paper.

In Figure 1 we show how public sector wages and employment co-move with a measure of business cycle fluctuations. We show simple correlations of real GDP growth with growth

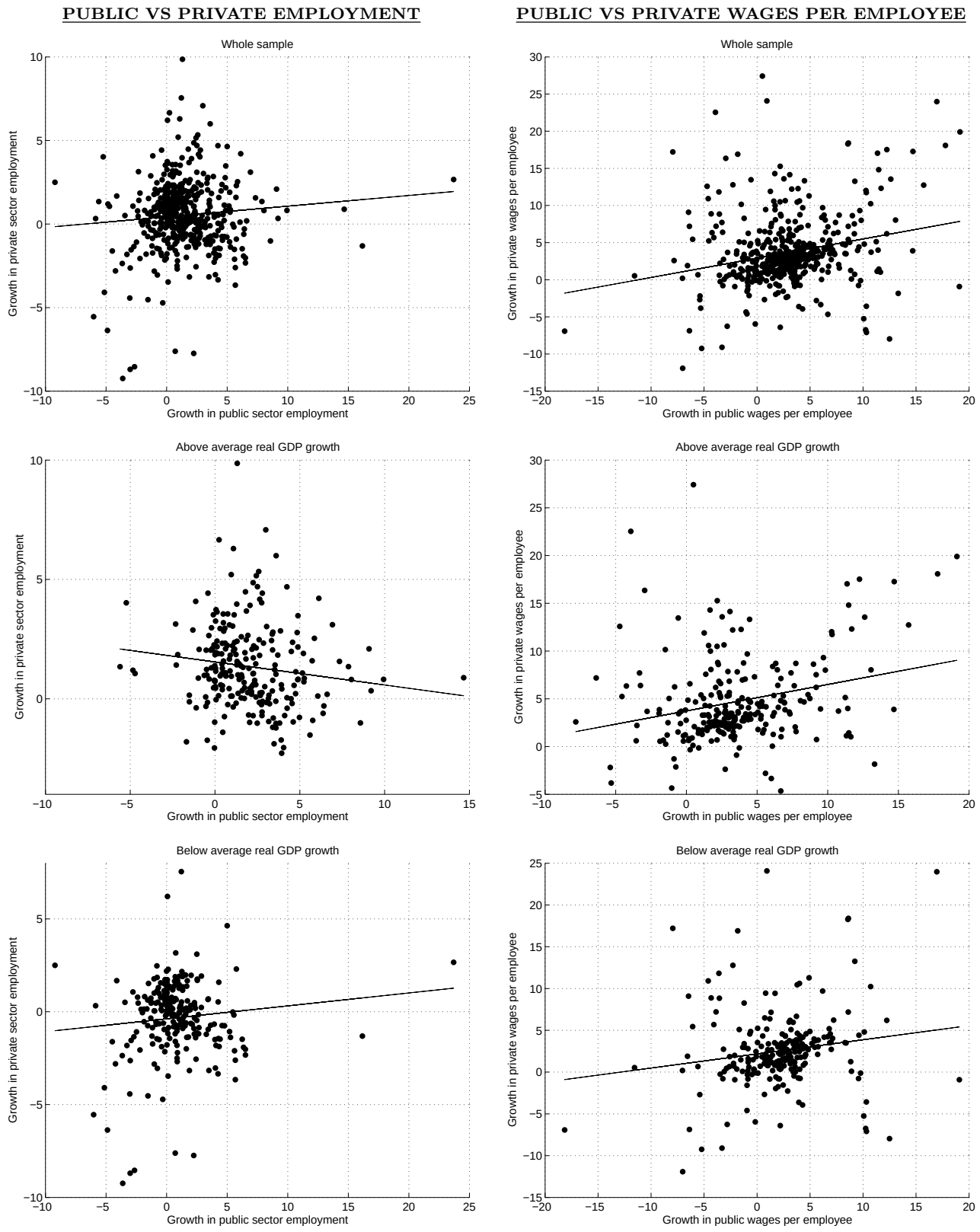
Figure 1: The cyclicality of public compensation of employees in the euro area (1970-2013).



NOTE: Data for Belgium (BE), Germany (DE), Ireland (IE), Greece (GR), Spain (ES), France (FR), Italy (IT), Netherlands (NL), Austria (AT), Portugal (PT), and Finland (FI).

SOURCE: OECD, Eurostat.

Figure 2: Private versus public employment and wages in the euro area (1970-2013).



NOTE: on sample and sources see footnotes to Table 1.

in public sector compensation of employees, and also with growth of its two components, namely public employment growth and growth of public sector wages per employee, over the period 1970-2012. Countries included in the scatter plot are: Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal and Finland, i.e. the original (i.e. since 1999 or 2001) euro area countries with the exception of Luxembourg (not included due to data shortages). As illustrated by the charts, the unconditional correlation coefficient in the three cases is positive. This exemplifies the by now proven result in the empirical literature that (lagged) pro-cyclicality of public wages and public employment predominates for the euro area and practically every euro area country (see Lamo, Pérez and Schuknecht, 2013a). The frequent finding of pro-cyclicality is consistent with the fact that upswing-induced revenue increases loosen governments' budget constraint (and the reverse in downturns). But there may also be institutional reasons (such as wage indexation) behind this stylized fact.[3]

It seems that public wage bill variables are not fully exogenous to the business cycle in euro area countries, as it would have been expected on the basis of a strand of the theoretical literature – and some empirical evidence mainly pertaining to developing countries and different historical episodes – but in contrast are somehow linked to the business cycle. This fact is also evident when looking at the linkages between public and private labor markets. Indeed, in Figure 2 we show the unconditional correlation line for the same set of countries mentioned in the previous paragraph over the same period of time (1970-2012) between public and private sector employment and wages. The first two panels of the chart display the scatter plots for the whole sample. As regards wages, this is just an illustration of the stylized fact that public and private sector wages in the euro area and for most of the euro area countries are positively and strongly correlated over the business cycle (see Lamo, Perez and Schucknecht, 2013b; 2013c, and the references quoted therein).

This is a very robust result across countries, in spite of very different institutional settings and different inflation regimes witnessed in the different decades covered by our study. Wage leadership arguments can provide a rationalization for this evidence. In the case of public

[3]Even if formal indexation exits in a limited number of European countries, *de facto* indexation is well widespread in Europe.

and private employment, an overall positive correlation is also observed. In this case, the literature would resort to political-economy related arguments to rationalize this correlation, namely that in upturns increased private sector activity (associated with increased private employment) would loosen the government budget constraint and as a consequence would allow the recruitment of additional staff (and the reverse in downturns).

In the second and third panels of figure 2 we move one step forward, and show those simple unconditional correlations for "good" and "bad" times, i.e. in above-the-average real GDP growth periods and below-the-average growth periods. Interestingly, while the results drawn from the whole sample scatter plot for the correlation between public and private wages are similar to those in the cases of high- and low-growth periods taken separately, this is not the case for public employment. Indeed, in bad times a positive correlation is observed, while in good times this correlation turns out to be negative. More specifically, in expansionary periods increases in public employment tend to be associated with reductions of private employment. This unconditional evidence could also be read as tentative evidence along the lines of the standard crowding-out result found in many studies (see the next Section for a survey), but, according to our rough evidence, it only holds in good times; in contrast, in bad times public and private employment appear to move in the same direction.

In Figure 3, in turn, we show the ratio of public to private employment for the euro area aggregate and Spain. After the increase in the weight of the public sector as an employer over the 1980s in a majority of euro area countries (see Holm-Hadulla et al., 2010), the chart shows that, as a general rule, the second half of the 1990s and the 2000s were periods of public sector downsizing, following a trend that continued up to the start up of the most recent economic crisis, when a sharp reduction in private sector employment, coupled with increases in public employment in some countries, led to an increase in the ratio. Among the large euro area economies, this profile is also noticeable for the case of Spain, and more marked. In this latter country, government employment as a ratio of private employment increased well until the end of the 1990s, and then increased significantly since 2007. The increase in the ratio in the most recent crisis reflects a sharp decrease in the denominator, but also a significant increase in the numerator, maybe because public employment policies were seen as a way to partially counteract massive unemployment.

The latter is a differential factor in the case of Spain, when compared with the euro area average. In fact, a consistent and systematic policy of public employment restraint only started to be implemented in Spain in 2010, and was only visible in the data in the course of 2011. At the same time, in any case, the process of job destruction in the private sector continued over the shown sample of data, and as a consequence the ratio of public to private employment picked up in 2012, reaching end of 1990s values.

Finally, Figure 4 shows the ratio of public sector wages per employee over private sector wages per employee. A comparison of public and private sector wages for the euro area as a whole reveals that, according to the national account aggregates used, the average/representative public wage has always been higher than the average private wage. This is consistent with the existence of a public sector wage premium that is generally found with macro data for developed economies, as highlighted, among others, by Holm-Hadulla et al. (2010).[4] In the case of the Spain, this ratio displays a higher level, a much higher volatility, and larger cyclical fluctuations. The figure also exemplifies the impact of public wages' reduction policies implemented by euro area countries under fiscal stress since 2010, as it is clear in the case of Spain.

Before the crisis public wages had been growing faster than private ones both in Spain and in the euro area as a whole. Conversely, starting with the crisis (change of slope of the ratio public sector over private sector wages around 2010), public sector wages grew at a slower pace as compared with those in the private sector, a fact that is more notable in Spain than in the euro area aggregate given that not all member countries were concerned by an episode of fiscal consolidation, as it was the case of Spain. It is likely that under conditions of fiscal distress not only wage setting practices in the government sector were affected, but also the interplay between government and private sector wages.

The stylized facts outlined in this Section highlight a number of relevant issues for the problem at hand. First, public and private wages present a positive co-movement, and this pattern seems to show up in good and in bad times alike. Second, in the case of employment,

[4]The determination of a wage premium with macro data unveils significant composition effects that have to be controlled for in order to assess the existence of a "true" pay gap - see Giordano et al. (2010), Depalo et al. (2013), de Castro, Salto and Steiner (2013) and the references quoted therein.

Figure 3: The evolution of the ratio of public to private sector employment in Spain and the euro area aggregate (circled line).

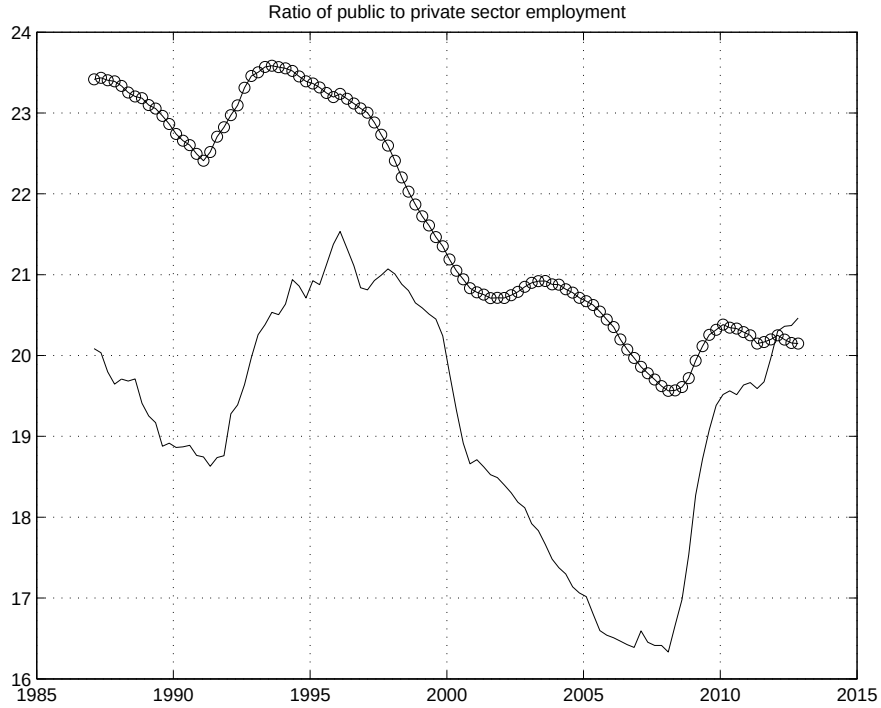


Figure 4: The evolution of the ratio of public to private sector wages per employee in Spain and the euro area aggregate (circled line).

the positive unconditional correlation observed for the whole sample seems to turn into a negative one in above-the-average real GDP growth periods. Third, the ratio of public-to-private wages (public-to-private employment) tend to decrease (increase) in bad times both in the euro area taken as a whole and in the particular case of Spain, displaying more marked cyclical fluctuations in the latter case.

3 Review of the literature

As discussed above, our paper empirically explores the interactions and relationship between, on one side, public and private employment and, on the other, public and private wages, taking into account that these relationships public/private employment/wages may have changed in the recent times characterized by economic recession and fiscal distress. It brings together the literature that aims at capturing the labor market linkages among the public and the private sectors with a recently growing bunch of empirical work on fiscal multipliers during recessions and expansions. The latter estimates regime-specific labor fiscal multipliers

Regarding the interplay between public and private employment, the theoretical literature offers a reasonable degree of consensus on the expected sign of the correlation of public and private employment: it is negative. In a neoclassical environment (Finn, 1996; Cavallo, 2005) an increase in government employment has a negative wealth effect on the consumer, but for plausible parameter values it also raises private wages and reduces private employment. The reason is that the higher labor supply caused by the negative wealth effect is lower than the increase in government employment, and hence private employment falls and the private sector wage increases, what is consistent with crowding-out effects. Pappa (2009) finds similar crowding-out results in a neo-Keynesian model with price stickiness. Ardagna (2007), in a general equilibrium framework with labor unions, also predicts crowding out, although through a different channel. The channel works as follows: an increase in public employment reduces the probability of being unemployed. If unemployment compensations are lower than the after-tax wage in the public sector, union members' reservation utility increases, leading to higher wages in the private sector.

Along the same lines are the partial equilibrium models of public/private employment

determination of Algan, Cahuc and Zylberberg (2002) and Forni and Giordano (2003), and general equilibrium models like Fernández de Córdoba, Pérez, and Torres (2012). Also related model-based arguments can be found in Calmfors and Horn (1986).

More recently, Bermperoglou et al. (2013) pose a sticky price DSGE model with matching frictions in the private and public sector, endogenous labor participation and heterogeneous unemployed jobseekers. According to their model, public wage cuts increase labor supply in the private sector and can undo the negative effects of the fiscal tightening, while public vacancy cuts reduce it and result in stronger contractions. A fall in public employment in their framework does not increase private employment since many long-term unemployed decide to exit labor force as they face a low probability of finding a job. Michaillat (2014), nevertheless, do find a "crowding-out" type effect of public on private employment, as he exploits a different channel. He develops a New-Keynesian model in which a type of government multiplier doubles when unemployment rises from 5 percent to 8 percent (calibration for the US). The latter multiplier indicates the additional number of workers employed when one worker is hired in the public sector. Increasing public employment stimulates labor demand, which increases tightness and therefore crowds-out private employment. When labor demand is depressed and unemployment is high, the increase in tightness and resulting crowding-out are small.

On related grounds, the empirical literature has provided support for the theoretical result of crowding-out of private employment by public employment. Nevertheless, despite some general consensus in the empirical literature, it is fair to say that the literature is not unambiguous in confirming the expected coefficient signs predicted by the theoretical literature. Malley and Moutos (1996), for the case of Sweden (quarterly data, 1964-1990), Malley and Moutos (2001) for Germany, Japan and the US, and Behar and Mok (2013) for developing countries, show evidence of full crowing out of public employment on private employment. Alesina et al. (2002) find a sizeable negative effect of public spending and in particular of its wage component (wage bill) on private-sector profits and on business investment. Ardagna (2007) claims that the latter results are consistent with the different theoretical models in which government employment creates wage pressure for the private sector, and thus can be used as anecdotal evidence supporting that the direction of causality

would go from public-sector employment to private-sector employment. Lamo, Pérez and Sánchez-Fuentes (2013) find that the degree of crowding-out/-in depends on institutional factors (mainly from the labor and product markets).

On different grounds, Perotti (2007) finds evidence of public-sector employment crowding-in on private employment. He estimates a VAR with US data with real GDP, private consumption, hours worked and the real wage in the business sector and manufacturing, real government spending on goods and total government employment. Among other things he finds that, in response to a positive government employment shock, there is a highly persistent response of government employment itself, with a response of hours worked in the business and manufacturing sectors being positive. His overall finding is one of crowding-in, also found for the US by Linnemann (2009). However, Pappa (2009) shows that the evidence regarding the dynamics of total employment following a government employment shock is mixed. In aggregate data the predictions of the Real Business Cycle (RBC) model are supported (total employment increases after a positive shock), while in about half of the US states labor market responses present the wrong sign (total employment decreases).

Regarding linkages between public and private sector wages, a strand of recent literature has documented the existence of such linkages from a macro and aggregate perspective. The main theoretical reference in this regard is the well-known Scandinavian model of inflation. With this, especially in the case of fixed exchange rates, there is an obvious case for the traded-goods sector being the wage leader (i.e., wage leadership is exerted by the sectors that are more open to competition; see, for example, Lindquist and Vilhelmsson, 2006). However, even though, theoretically and normatively, there is a strong case for private-sector wage leadership, there are important reasons why this might not always or not fully occur in practice, and why wage spillovers from the public sector might lead to wage costs growing faster than productivity in the private (including the tradable) sector. Nevertheless, this model is sometimes at odds with the empirical literature. Empirical results differ depending on the country analyzed and the specific sample, but also depending on the methodology adopted.

There is a wide and growing literature that has looked at the dynamic interaction between public and private wages using Structural Vector Auto-regression (SVAR) models to

estimate the joint dynamic behavior of public and private wage variables, as SVARs allow analyzing whether there is causality and in what direction it runs. In the case of sectoral interactions concerning public and private wages, Friberg (2007) does not find evidence of private sector leadership for Sweden (along these lines, see also Holmlund and Ohlsson, 1992; Tagtstrom, 2000). In contrast, Lindquist and Vilhelmsson (2006) apply a vector error correction approach to wage setting in Sweden. Using annual data for the period 1970-2002, they find long-run wage leadership by the private sector. Meanwhile, Demekas and Kontolemis (2000) find weak exogeneity of real government wages for private-sector behavior in a VAR analysis for Greece (1971-1993). Afonso and Gomes (2008) for a panel of OECD countries find that the growth of public sector wages and of public sector employment positively affects the growth of private sector wages.

Lamo, Pérez and Schuknecht (2013, 2012a, 2012b), and Pérez and Sanchez-Fuentes (2011) investigate both short term public private wages linkages and their long term relationship. They confirm that the impact of the private sector on the public sector appears, on the whole, to be stronger (for most countries) than the other way round. However, there is also evidence of feedback effects from public wage setting on private-sector wages in a number of (European) countries. Lamo, Pérez and Schuknecht (2012) estimate a VECM model on 18 OECD countries over the 1970-2006 period. The authors find long-run wage leadership by the private sector in the US, Canada, the UK, Sweden, Austria, Greece, Italy, Spain, and Portugal. The public sector exercises long-run leadership in Ireland, Norway, Denmark, Finland, Germany, France, the Netherlands and Belgium. In the short-run, private wages take the lead in Denmark, Finland, Germany, France, the Netherlands, and Belgium. Short-run public sector leadership is manifest only in Spain and the UK. footnote. Wage leadership is generally identified in the short run from the analysis of Granger causation, and in the long-term from the analysis of the adjustment to the long-term relation (the adjustment being fully achieved by the wage changes in the sector without leadership). Along similar lines, Pérez and Sánchez-Fuentes (2011) use a standard VAR framework to identify intra-annual interactions between private and public wages. The authors find strong evidence of signalling effects across the two sectors that are especially strong in France and Germany in the pre-EMU period. In the case of Spain they find that private sector wages lead in the

long run, while there is evidence of public wages causing private wages in the short run. For the case of the Netherlands the paper by Zeilstra and Elbourne (2013) find no evidence for public wage leadership. Moreover, public wages return to their previous equilibrium value three to four years after an exogenous shock in public wages. By contrast, an exogenous shock to private wages has a permanent influence on both private and public wages.

There is some literature supporting rent-seeking theories and the role of election cycles. For example, Borjas (1984) finds that pay hikes during the presidential election year are significantly greater than pay raises in other years, and Matschke (2003) shows empirical evidence of public employees' pressure in Germany ahead of political elections.

Within the fiscal multipliers literature, Bermperoglou et al. (2013) find in a SVAR framework that cuts in the wage bill component identified as government vacancy cuts generate the largest output losses and achieve the smallest deficit reductions, regardless of the sample and the country (US, Canada, Japan, the UK), and significant unemployment losses in the US and the UK, while wage cuts have, if anything, insignificant expansionary effects to achieve the largest deficit reductions.

Similarly to what happens with the empirical literature on public-private employment interaction, much of this previous literature on wages neglects the possibility of regimen specific results in order to allow the existence of non-trivial non-linearities, this paper borrows form the literature on fiscal multipliers and uses the nowadays standard Smooth Transition models, STVAR in the estimation of state-contingent fiscal multipliers, as in the seminal work of Auerbach and Gorodnichenko (2012a, 2012b). See also Ramey and Zubairy (2013) for an alternative approach.

4 The data

4.1 Euro area data

The euro area is an aggregation of member states' country-specific time series. There is nothing like "euro area public employment/wages". Nevertheless, the monetary policy of the ECB is conducted taking into account euro area aggregates as if they were representing

a single entity/country. Thus, the ECB has devoted a great deal of effort in building up consistent databases of country-specific data and in the development of aggregation tools to assemble euro area aggregates for the different macroeconomic variables. Thus, we take the euro area aggregate figures for the period 1980Q1-2012Q4 from ECB's Area Wide Model Database (see Fagan, Henry and Mestre, 2005; Gumiel, 2012). This database is disseminated regularly through the official AWM site with the Euro Area Business Cycle Network (www.eabcn.org\data\awm\index.htm).

In the fiscal domain, Eurostat and the ECB provide annual series for euro area fiscal aggregates that dates back to the 1980s. In addition, Eurostat, on the basis of data provided by EU National Statistical Institutes, provides quarterly non-seasonally adjusted, non-financial government data for the euro area for the period starting in 1999Q1. The compilation practices follow the guidelines of the manual on quarterly non-financial accounts for general government (see European Commission, 2006). Using the latter accounting approach to extend back in the past existing euro area fiscal time series is not a feasible endeavour, though, given the limited information available. Thus, as regards fiscal data, given the limitations and the scarcity of quarterly euro area fiscal data, we have opted for the quarterly fiscal data set compiled by Paredes, Pedregal and Pérez (2009; 2014). They employ intra-annual (monthly and quarterly) fiscal data in a mixed frequencies state space model to obtain quarterly fiscal data for the aforementioned period. The procedure used ensures consistency with annual and quarterly national accounts data where available.

The main advantage of the Paredes et al. data set is that it avoids the endogenous bias that would arise if fiscal data interpolated on the basis of general macroeconomic indicators were used with macroeconomic variables to assess the impact of fiscal policies. Indeed, their database is built up using only intra-annual fiscal information, i.e. they do not use general quarterly macroeconomic variables - like GDP, private consumption or total economy employment - in the interpolation process. This is a quite relevant issue because although government revenues and expenditures (e.g. unemployment benefits) may be endogenous to GDP or any other tax base proxy (e.g. private consumption for VAT collection) the relationship between these variables is at most indirect and extremely difficult to estimate. The decoupling of tax collection from the evolution of macroeconomic tax bases (revenue

windfalls/shortfalls) is by now a proved stylized fact. In this respect, the direct use of intra-annual fiscal data, taken from public accounts' sources, for interpolation purposes, is certainly instrumental to avoiding the potential problem of modelling an indirect relationship which, in addition, might be time-varying.

In Paredes et al. (2009; 2014) fiscal variables are seasonally adjusted according to the statistical model used to draw the corresponding quarterly data. The issue of seasonal adjustment of quarterly fiscal variables in Europe is an important one, as signalled in European Commission (2007). Currently, available quarterly government finance official figures are presented only in non-seasonally adjusted terms, given the relatively short time span available (the starting period is 1999Q1), two features that make difficult the economic analysis with those figures. Indeed, adjusting in a robust way for seasonality such short time series is a difficult endeavor. In this sense, given that they use a broad set of information and model explicitly seasonality for the whole set of series included in their models, for the period 1980Q1-2012Q4, they are in a position to provide, in particular, seasonally adjusted series computed in a robust way for the period for which the official statistics are available (1999Q1 onwards).

The potential for policy applications of the Paredes et al. (2009; 2014) database has been tested in a number of recent papers that have used it (e.g. Burriel et al., 2010; Batini, 2011; Coenen et al., 2012, 2013; Cimadomo, 2011; Cimadomo et al., 2012; de Castro and Garrote, 2011; Brand, 2012; Kollmann et al., 2012). In addition, since the September 2010 edition of the euro area AWM database (see Fagan et al., 2001, 2005), the Paredes et al. (2009; 2014) database has been adopted as the fiscal block of the AWM database.

4.2 Data for Spain

In the case of Spain, quarterly General Government figures on an ESA95 basis are available only for the period 2000 onwards, in non-seasonally adjusted terms, and are released by the accounting office IGAE. Unfortunately, this information is not available for previous years. Two existing databases have been built in previous studies to overcome this lack of official statistics. A first quarterly dataset is the one compiled by Estrada et al. (2004). This database is the one used to estimate and simulate Banco de España's quarterly macroe-

conometric model (MTBE henceforth) and thus the interpolation procedure applied and the indicators used were selected with this specific purpose in mind. Except for public consumption, standard interpolation techniques – Denton method in second relative differences with relevant indicators – were applied to pre-seasonally-adjusted figures, with no specific attention being paid to the inputs used in the interpolation of fiscal variables. This is a valid approach given the stated uses of the MTBE model and the generated quarterly fiscal dataset is fully consistent with model definitions. A second information source is the REMS database (see Boscá et al., 2007), companion to the REMS model – a DSGE model currently used within the Ministry of Economy and Finance to carry out policy simulations – that includes a quite detailed fiscal block with quarterly variables. The fiscal variables in that block are obtained by means of simple interpolation of annual fiscal figures.

In our paper we decided to use the macro data from Bank of Spain's MTBE database, and fiscal data from de Castro et al. (2013). The latter dataset uses the same methodological approach as in Paredes et al. (2009, 2014) to build up a consistent and comprehensive set of fiscal time series for the period 1986Q1 to 2012Q4. We consider this dataset as a preferred alternative compared to the two commented upon in the previous paragraph for a number of reasons. First, the Paredes et al. (2009, 2014) approach is built upon a proven and transparent methodology, as discussed above. Second, the database by de Castro et al. (2013) makes use of only intra-annual fiscal information. Third, as in Paredes et al. (2009), this database for Spain follows to the extent possible some of the principles outlined in the manual on quarterly non-financial accounts for general government: use of direct information from basic sources (public accounts' data), computation of "best estimates", and consistency of quarterly and annual data.

4.3 Some general remarks on public employment data

The measurement of government employment is, surprisingly enough, a matter of concern in the literature dealing withe analysis of public employment and public wages per employee. Several definitions do exist, as discussed in Annex A. In the specific case of put study, thus, we explain now in detail what number we do exactly use.

For the case of the euro area, it is worth mentioning that not all European Union member

states report to Eurostat standardized annual employment figures for the general government sector. Thus, it is necessary to resort to other sources. As in Pérez and Sánchez-Fuentes (2011), Paredes et al. (2009; 2014) use annual OECD figures as the anchor for the computation of the euro area aggregate. As regards quarterly information, the available sources covering a wider time span can be found in Eurostat's ESA95 figures on "Employment in other services", mainly non-market services, the bulk of which are related to government activities. The database we use takes data from this source for the period 1980Q1 onwards for Germany, Spain and Italy, for the period starting in 1990Q1 for France and for the period 1987Q1 onwards for the Netherlands. As an additional indicator they also used euro area real government consumption, given that government consumption in real terms should contain information of changes in government employment underlying government compensation of employees.

For the case of Spain, the government employment figures of reference in de Castro et al. (2013) are the bi-annual series of the "Registro Central de Personal", which consist of administrative records compiled by the Ministry of Finance but covering the general government sector. This is the best source of public employment data for Spain, given the absence of genuine ESA95 government employment data (see Botella et al., 2009). As regards quarterly information, a number of sources are available that do refer to concepts that are somehow closely related to ESA95 government employment. These sources are: (i) The Labour Force Survey, that provides a general government proxy classification; (ii) affiliates to the Social Security on non-market services; (iii) within ESA, the NACE L-P sectors referred to "core" public administration, education (including private sector) and health (including also private sector workers).

5 Econometric Methodology

We first estimate standard SVAR models in which public and private sector labor market variables are allowed to interact. This will be done by bringing together the literature on fiscal SVARs and some labor market literature (see e.g. Pappa, 2005; Linnemann 2009; Lamo, Perez and Schuknecht, 2012; Ramey, 2012). Then, in order to allow the effect of

public employment/wages on private sector employment/wages to vary across expansion and recession, we consider a smooth transition vector autoregression model (STVAR) as in Auerbach and Gorodnichenko (2012a,2012b). With such an approach we aim at capturing the regime-specific labor market linkages among the public and the private sectors. Intuitively, this approach is based on a VAR with two regimes and different parameters governing the contemporaneous and dynamic public-private labor market interactions in each regime. Despite this approach was originally developed for the analysis of state-dependent multipliers of public spending (see Auerbach and Gorodnichenko, 2012a), it is straightforward to adapt the methodology to the case of the "public employment/wages multiplier".

Along these lines, some authors have employed threshold VAR – TVAR – approaches aiming to estimate state-specific multipliers over the business cycle (see e.g. Baum and Koester, 2011, for Germany). While the TVAR discretely switches from one to another regime, STVARs allow the regimes to change smoothly from one regime to another.[5] We consider the STVAR framework because we think it is very unlikely that the economy jumps between the regimes in a discrete fashion as imposed by the TVAR approach.

The econometric specification of our STVAR model is:

$$Y_t = C + (1 - F(z_{t-1}))\Phi_{EXP} Y_{t-1} + F(z_{t-1})\Phi_{REC} Y_{t-1} + e_t \quad (1)$$

$$e_t \sim iid(0, \Omega_t) \quad (2)$$

$$\Omega_t = \Omega_{EXP}(1 - F(z_{t-1})) + \Omega_{REC} F(z_{t-1}) \quad (3)$$

$$F(z_t) = \frac{exp(-\gamma z_t)}{(1 + exp(-\gamma z_t))}, \ \gamma > 0 \quad (4)$$

where the sub-indices EXP and REC refer to the two possible states of the economy, namely, expansion and recession. Also, the vector Y_t contains the variables of interest. There are two benchmark cases. The first one in which Y_t contains logarithms of public employment, private employment, and real GDP observed at a quarterly frequency. The second one in which it includes public wages per employee, private wages per employee, and overall labour productivity. Moreover, the matrices Φ_{EXP}, Φ_{REC}, Ω_{EXP}, and Ω_{REC} contain the coefficients of the lag polynomials and the variance-covariance matrices of the shocks in the different

[5]From a practical point of view, within the STVAR approach all observations in the sample can be used for estimation of the parameters in both regimes.

regimes. Note that equation (1) contains one single lag to avoid notational clutter; however, we estimate the model considering a maximum of three lags selected based on information criteria. Indeed, the proliferation of coefficients to be estimated combined with the reduced sample size available for estimation preclude us from including additional variables in the model and it represents a concern of the STVAR approach.

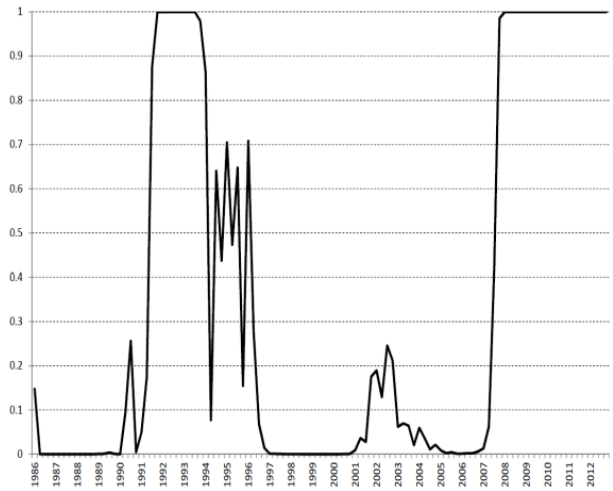
Finally, z_t is an indicator of the state of the economy in quarter t, normalized to have zero mean and unit variance. In particular, we follow Auerbach and Gorodnichenko (2012a) and consider the normalized seven-quarter moving average of GDP growth. Thus, the weights assigned to each regime vary between 0 and 1 according to the weighting function $F(\cdot)$ so that $F(z_t)$ can be interpreted as the probability of being in recession. Note also that the index z is dated at $t-1$ to avoid contemporaneous feedbacks from policy actions to the state of the economy. In addition, we also estimate the models with z_t being the unemployment rate (with the same transformation as in the case of real GDP mentioned above).

In Figure 5 we show the estimated weights on the recession (high-unemployment) regime, given by the $F(z_t)$ function, for the cases Spain and the euro area aggregate, respectively. In the case of real GDP, in both cases the indicators seem to capture appropriately the recessions typically characterized by the extant literature. The 1990s, the 2000s and 2008-on crises, with the 2000s being almost irrelevant in the case of Spain.

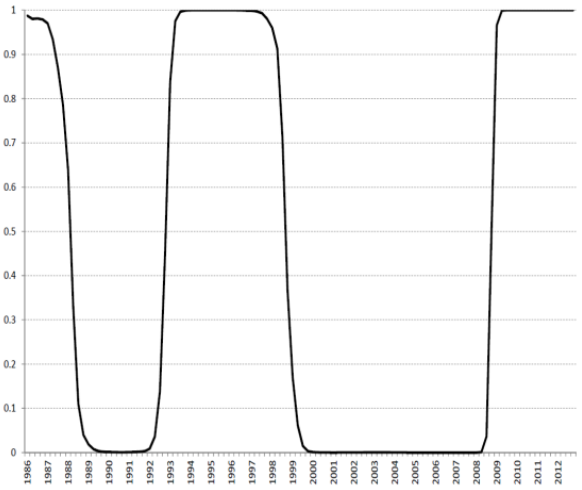
Identification of public employment/wages shocks in model (1)-(4) is based on Cholesky ordering with public employment/wages ordered first, private employment/wages second, and GDP/productivity third. This particular ordering of the variables implies that public employment does not react to neither private employment nor GDP within the current quarter. This kind of contemporaneous exogeneity assumption of public employment has been typically considered in the literature. For instance, Malley and Moutos (1996) assume than public employment is weakly exogenous in a VEC-ECM model including public employment, private employment and the stock of capital. Along these lines, Algan et al. (2002) consider a panel approach and intrument public employment with its own lags assuming lack of contemporaneous correlation between public employment and shocks to private employment. Finally, Linnemann (2009) considers a linear VAR model with public employment ordered first, private employment second and GDP third.

Figure 5: Regime indicators: estimated weights on the recession (high-unemployment) regime, given by the $F(z_t)$ function, for the cases Spain and the euro area aggregate, respectively.

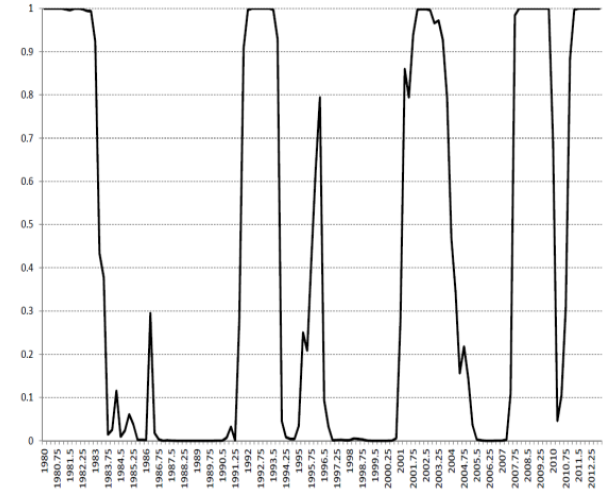
Spain - regime indicator: real GDP



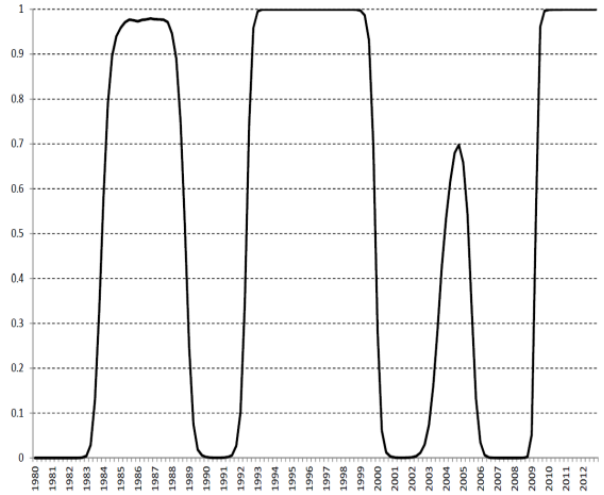
Spain - regime indicator: unemployment rate



Euro area aggregate - regime indicator: real GDP



Euro area agg. - regime ind.: unemployment rate



6 Empirical results

We indeed find evidence of regime-dependent linkages among the public and the private labor markets. In this Section we show the results in which we identify the regimes using the (4-quarter moving average of) GDP.[6] The main results of our empirical exercise are presented in figures 6, 7, 12, 13, 8, 9, 14, 15, 10, 11, and tables 1 and 2.

First, in figures 6, 7, 12, and 13, we show the responses of the linear model to a 1% shock. In these cases the impulse responses are invariant to history and to the state of the economic cycles. Next, in the rest of figures we present the state-dependent responses to a 1% shock using the STVAR method with GDP as the indicator defining the change of regime. The red dashed line and the blue one represent the responses in "recession" and "expansion", respectively. In all cases the grey areas do refer to 95% confidence bands. Finally, Table 1 displays the multipliers that correspond to the effect of a shock to public employment on private sector employment. We report the impact multiplier and the cumulative multiplier at some horizons: four quarters and eight quarters. The reported multipliers correspond to the cumulative effect in the private sector (measured in number of employees) of a 1-person shock to public employment. As mentioned above, multiplier estimates based on the regime switching VAR —STVAR— discussed in Auerbach and Gorodnichenko (2012a). Identification of public employment shocks based on Cholesky ordering with public employment (N_G) ordered first, private employment (N_P) second, and GDP third. Similarly, Table 2 reports the multipliers that do correspond to the effect on private wages of a one percent shock to public wages. Again, we report the impact multiplier, and the cumulative multiplier at two longer horizons. In all the empirical material we only show responses up to eight quarters to account for the fact that a change in regime may occur while in the simulation horizon, and as a consequence, as discussed in Ramey (2013), it is important to focus on short-term responses.

Looking first at the linear case, private employment does not seem to react to government employment shocks in the euro area case (Figure 7), thus there is no significant evidence of

[6]Results using the unemployment rate as the variable defining the regime are available from the authors upon request. The main messages that can be drawn with this latter alternative are broadly consistent with the ones discussed here using GDP.

either crowding out or crowding in during the period of analysis and no further insights are found when looking at the multipliers in Table 1. The case of Spain (Figure 6) is equally one of a non-significant reaction of private employment to a positive public employment shock.

In fact, the absence of significant results in the linear case hints towards the relevance of the state-dependent approach taken up in our paper. In the state-dependent case, this apparent absence of influence of non-systematic policy changes gets qualified, as it is clear from figures 8 and 9. As a reaction to a public employment positive shock we find that, while in expansions (using real GDP as the variable defining the state) the effect on private employment is negative – though hardly significant from a statistical point of view in the case of Spain. This negative correlation is in line with previous results in the empirical and theoretical literature, and can be interpreted as evidence of "crowding-out". In recessions, however, the correlation is positive; a shock to public employment generates a positive response in private sector employment. This dual result (dependent on the "regime") was already hinted in Section 2 when looking at the descriptive evidence of figure 2, that plotted a positive unconditional correlation between public and private sector employment growth during the expansion periods. When looking at quantitative estimates, the multipliers in Table 1 show that indeed the cumulative effect after four and eight quarters in Spain is positive, significant and relatively high (2.45 and 3.15, respectively). It is worth noticing that public employment shocks are very persistent in the considered cases. This might be a reflection of the fact that public employment restraint policies tend to last several quarters in fiscal consolidation periods, while in fiscally loose periods the opposite may happen.

In the case of Spain there is also a positive reaction of real GDP in the recession case, while for the euro area aggregate the response is not significant from a statistical point of view. In the "good times" case, the effect on real GDP is non-significant in the Spanish simulation, while it is estimated to be negative in the second year for the euro area as a whole. This is in line with Bermperoglou, Pappa and Vella (2013), that find that cuts in the wage bill component identified as government employment cuts generate large output losses regardless of the sample and the country. Wage cuts is contrast have, if anything, insignificant expansionary effects and achieve the largest public deficit reductions according to these authors.

To deepen the intuition on the possible channels through which public employment shocks may affect private employment, in figures 10 and 11 we show the effect of public employment shocks ina modified model: the variables included are now public employment and private employment, as in the previous case, while instead of real GDP we add private sector wages. As it is apparent from the figures, the effects of public employment shocks on private employment are the same as those found with the previous model. The impact on private sector wages, in turn, are quite interesting. Indeed, in recessionary periods the positive effect on private employment comes hand-in-hand with a reduction in private sector wages, while in the "expansion" regime the crowding-out on private employment is accompanied by an increase in private wages. The private sector wages' channel has been underlined, in fact, by the related literature, as one of the main channels to rationalize crowding-out effects. Qualitatively, the impulse-responses are similar in the case of Spain and the euro area aggregate, but in the latter case the size of the responses tend to be somewhat exaggerated, what may be a reflection of problems with the specification and estimation of the models. We tried different robustness alternatives but the size of the responses remained in the orders of magnitude present in the figure we have included in the paper.

As regards public sector wages' shocks, the results of the linear SVAR for the case of Spain (see Figure 12) show a positive reaction of private wages to an increase in public wages, with a 1% increase in public wages leading to a within-the-quarter response of 0.5% in private sector wages. This is also reflected in Table 2 in the positive and significant multipliers that range from 0.41 to 0.52. Put it differently, a negative shock to public wages – i.e. for example, a non-expected cut due to fiscal pressures, as witnessed recently in many European countries – is associated with a fall in private sector wages. Instead, in the euro area case, as it is apparent from Figure 13, there is no significant reaction of private wages.

Again, as in the case of public employment, the impulse responses that we present in figures 14 and 15 show the importance of considering alternative states of the economy to study the linkage between the public and private labor markets. In the case of Spain regime-dependent responses, even if also positive, show very different dynamics in expansion than in recession. In good times or expansion a positive shock to public wages is indeed associated with a positive response of private sector wages, but the response quickly fades away, with

an impact multiplier of 0.5, while the cumulative multiplier at four quarters is already close to zero, and so is the one at the eight quarters horizon. In contrast, in the bad-times state the effect was much more persistent, despite the similar persistence of the shock. In this latter case the impact multiplier estimate is 0.38, and the four and eight quarter cumulative multiplier are 0.39 and 0.52, respectively.

On the contrary, when the euro area is taken as a whole, the public shock in good ties produces a reduction of private sector wages and it comes hand-in-hand with a reduction in productivity (see Figure 15)). In the bad-times state of recession, a negative shock to public wages in the euro area case is associated, though, with a fall in private sector wages. The channel to explain this apparent contradictory result seems to be linked to the response of productivity. Indeed, in response to the increase in public wages, labor productivity falls, and this fall is associated with a fall also in private sector wages, given that both magnitudes should be linked in the private sector under flexible labor market conditions and negotiations. The sign of the response had to be certainly determined by the degree of complementarity and/or sustitutability of public and private activities. Clearly this issue deserves further research. In any case, the observed reaction, similarly to the one in the case of Spain, displays strong persistence. The impact multiplier is estimated to be 0.38 and the four and eight quarter cumulative multiplier estimates are 0.78 and 0.47, respectively (see Table 2).

7 Policy discussion and conclusions

Some policy lessons can be drawn from our study, that includes descriptive evidence, a deep description of the relevant theoretical and empirical literature, and some empirical exercises.

First, we find evidence that in expansions public employment may crowd-out private employment, at least in the short-run. This response of private employment is also accompanied by an increase in private sector wages. In recessions, though, an unexpected increase in public employment leads to higher private employment. From a policy point of view, and in the framework of the "economic growth-vs-fiscal consolidation" debate, these results would advise against aggressive policies of public employees' firing in the the midst of a recession and/or when unemployment is high, at least from a short- to medium-run perspective.

Second, on the wage side, we validate and extend the by now standard result that public wages may lead private sector wages; indeed, we read the fact that the mechanism mainly operated in recessions as a signal that policies of public wage restraint may set in motion a labor market adjustment that otherwise would have taken longer and would have been, consequently more costly for the economy as a whole. When fiscal and competitiveness problems exist, public wage restraint could help correcting both fiscal imbalances and – through the interlinkage with private wages – competitiveness problems. A reading of this result in the case of Spain, the recent public sector wage restraint policies (mainly in 2010 and 2012) may have contributed to the recently observed wage moderation, as an additional factor together with the more internal flexibility granted to firms by the 2012 labou market reform and the inter-confederate agreement of February 2012.

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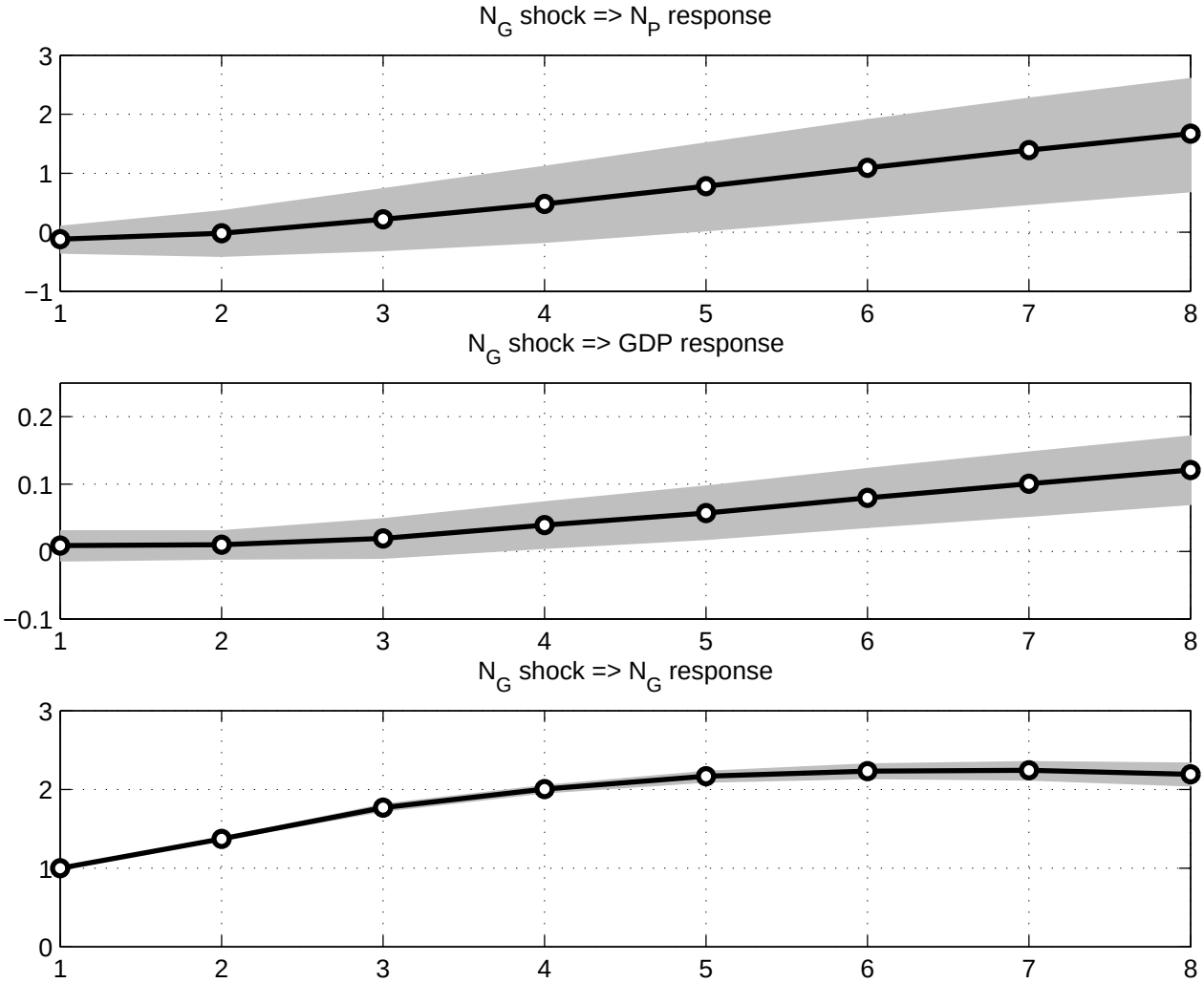
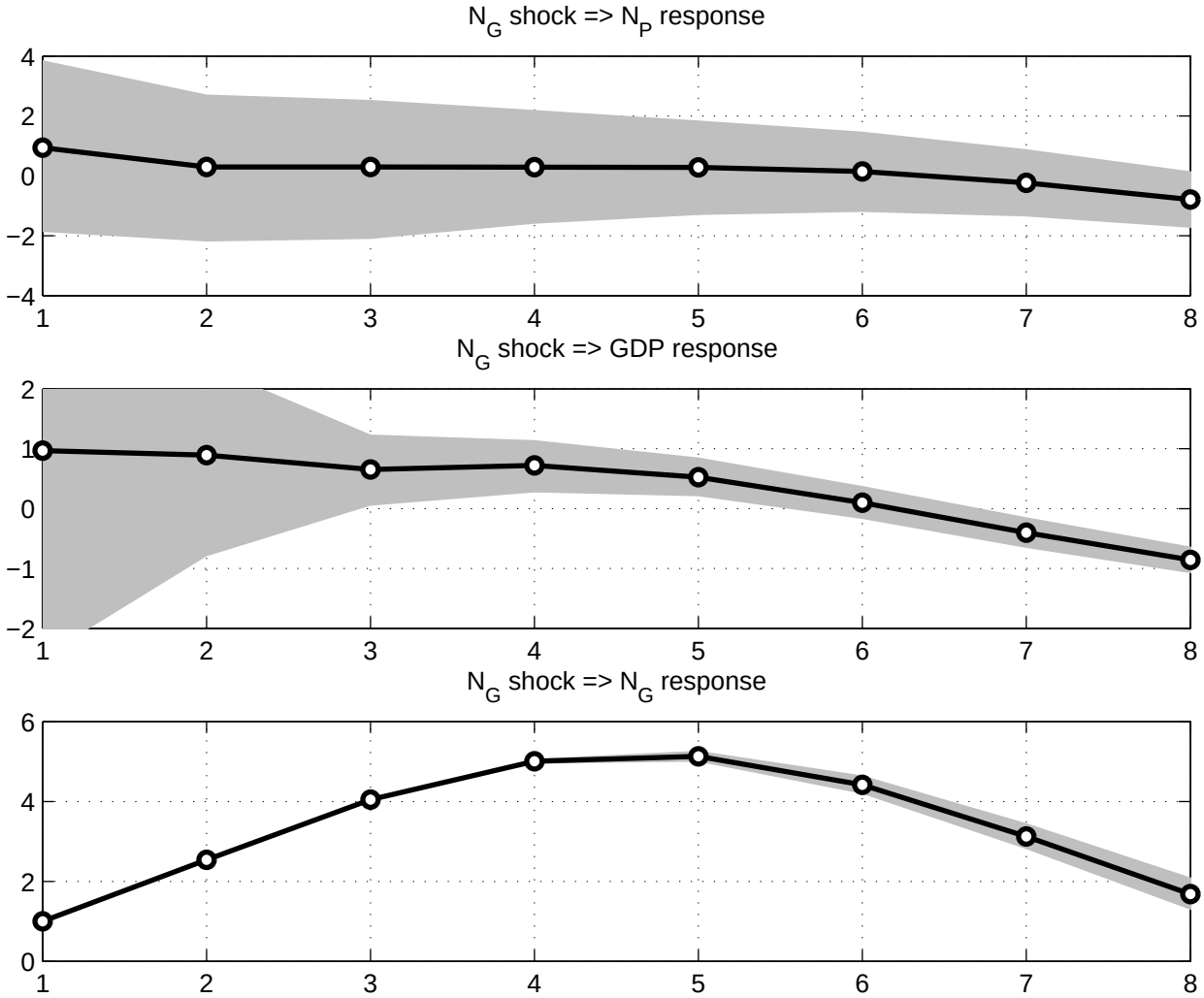
Figure 6: Spain. Impulse response functions to a public employment shock: standard SVAR linear response.



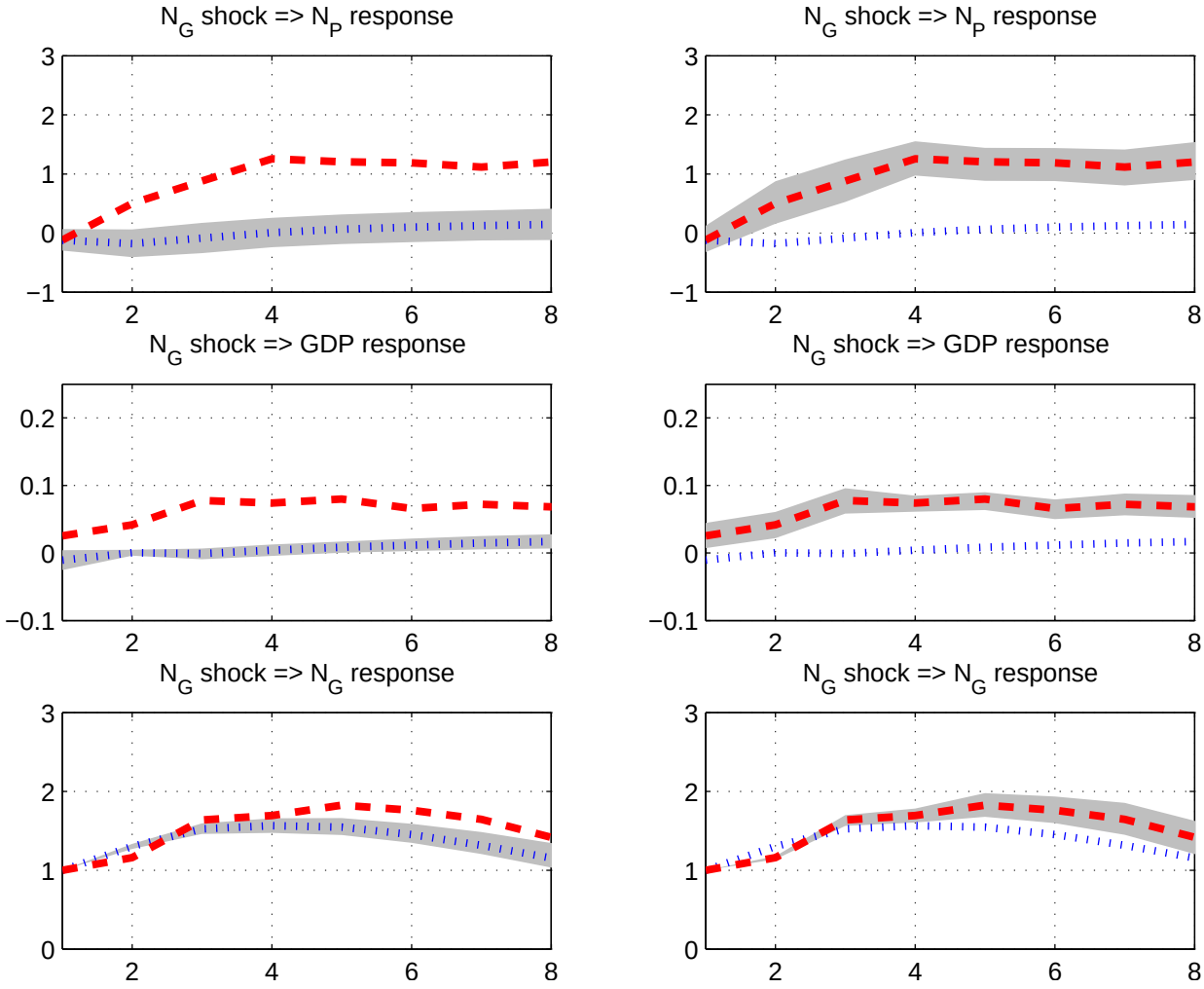
NOTE: The figures show the state-dependent responses to a 1% shock using the SVAR method. Grey areas are 95% confidence bands.

Figure 7: Euro area. Impulse response functions to a public employment shock: standard SVAR linear response.



NOTE: The figures show the state-dependent responses to a 1% shock using the SVAR method. Grey areas are 95% confidence bands.

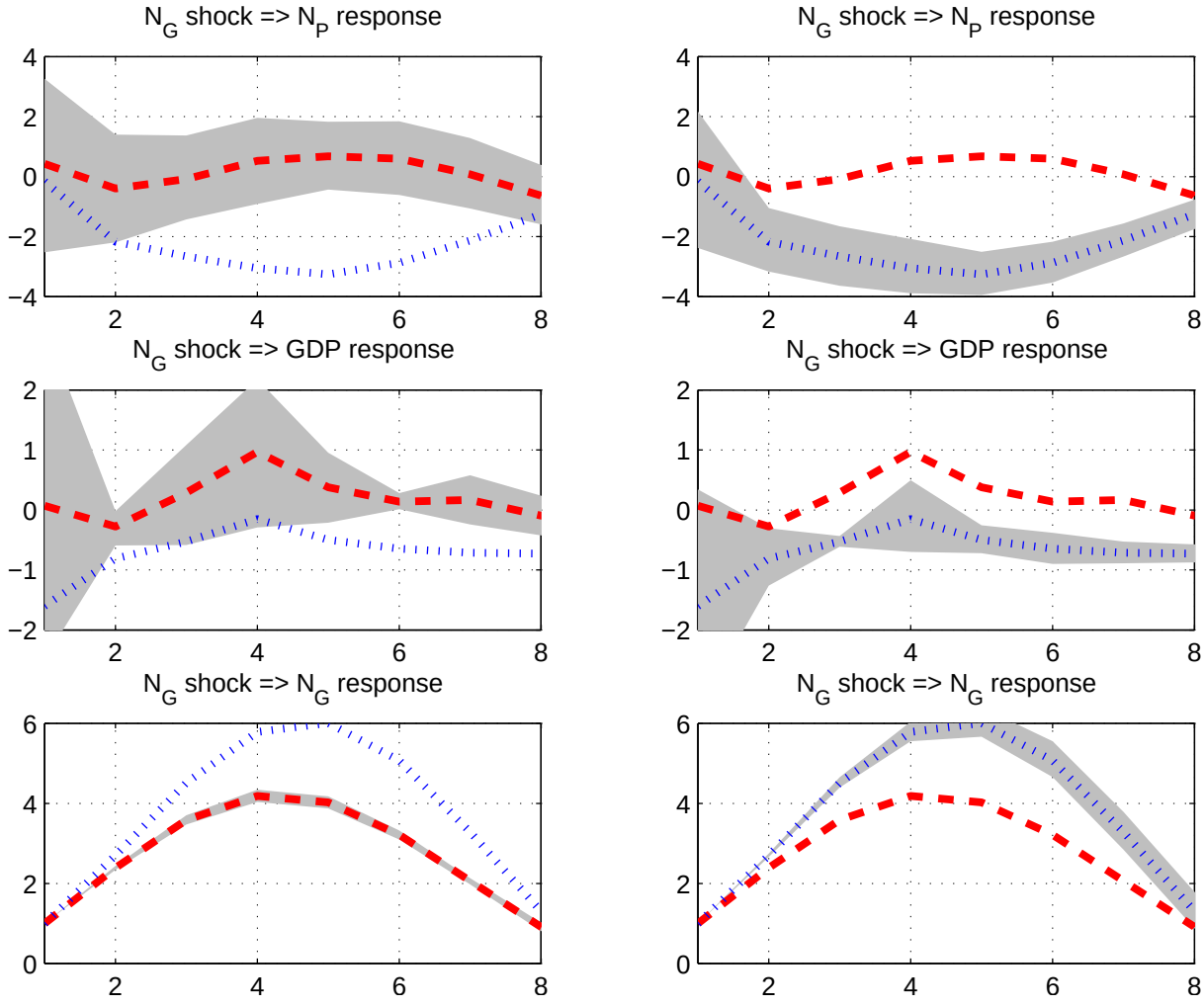
Figure 8: Spain. Impulse response functions to a public employment shock across regimes (recession/expansion). Smooth Transition VAR.



NOTE: The figures show the state-dependent responses to a 1% shock using the STVAR method. Response in "recession": red, dashed line.

Response in "expansion": blue dotted line. Grey areas are 95% confidence bands.

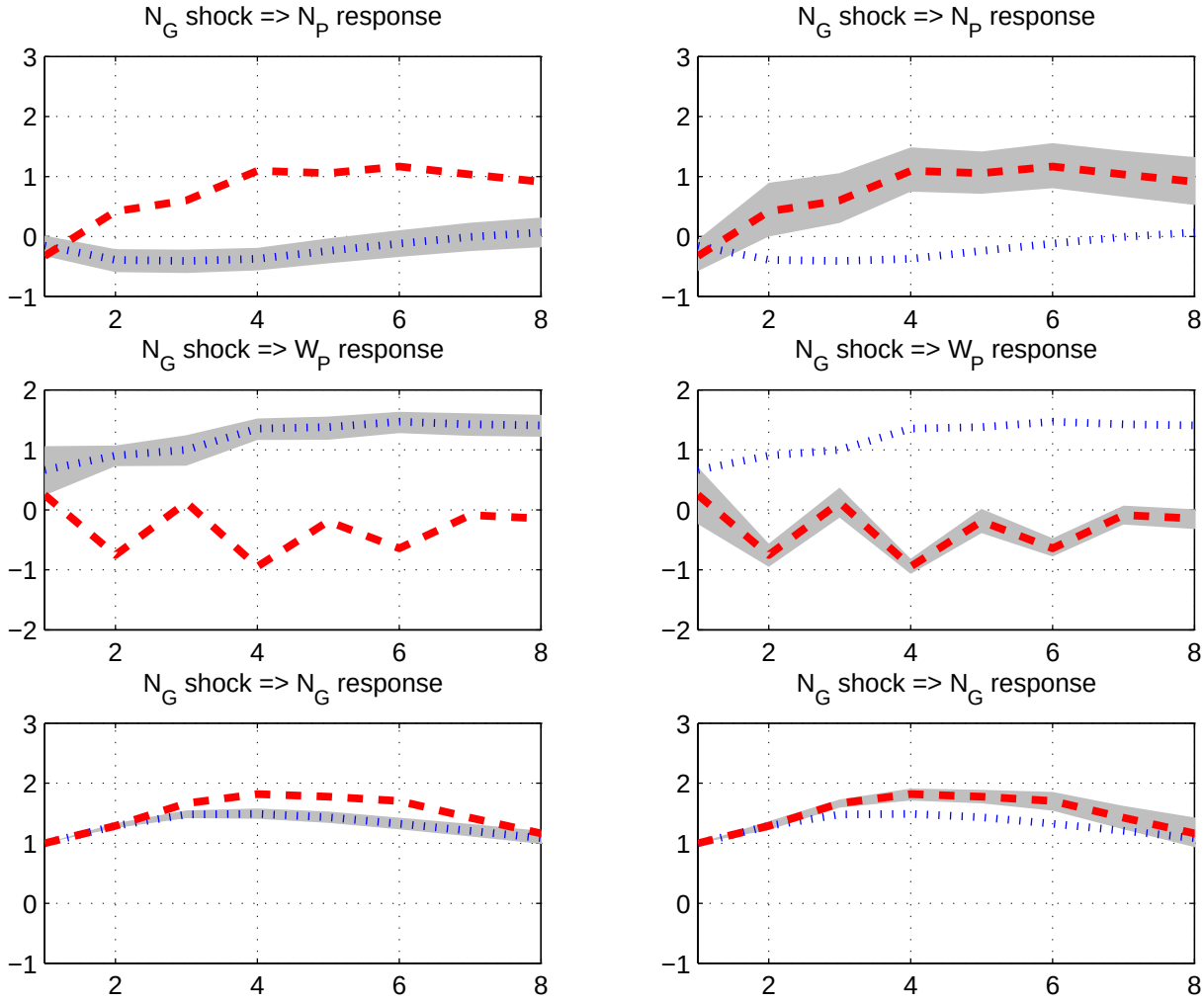
Figure 9: Euro area aggregate. Impulse response functions to a public employment shock across regimes (recession/expansion). Smooth Transition VAR.



NOTE: The figures show the state-dependent responses to a 1% shock using the STVAR method. Response in "recession": red, dashed line.

Response in "expansion": blue dotted line. Grey areas are 95% confidence bands.

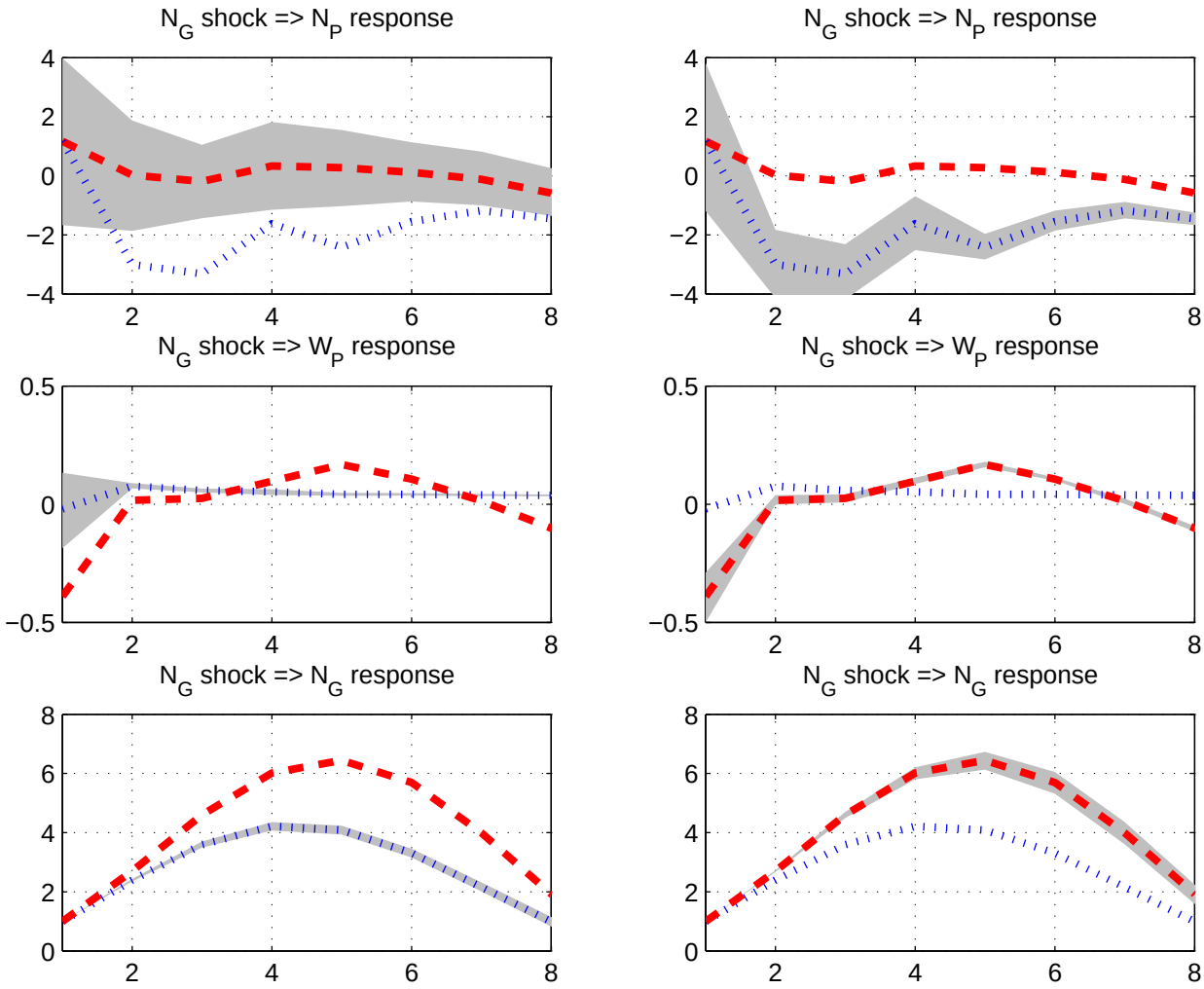
Figure 10: The effect of public employment shocks on private sector wages. Spain. Impulse response functions to a public employment shock across regimes (recession/expansion). Smooth Transition VAR.



NOTE: The figures show the state-dependent responses to a 1% shock using the STVAR method. Response in "recession": red, dashed line.

Response in "expansion": blue dotted line. Grey areas are 95% confidence bands.

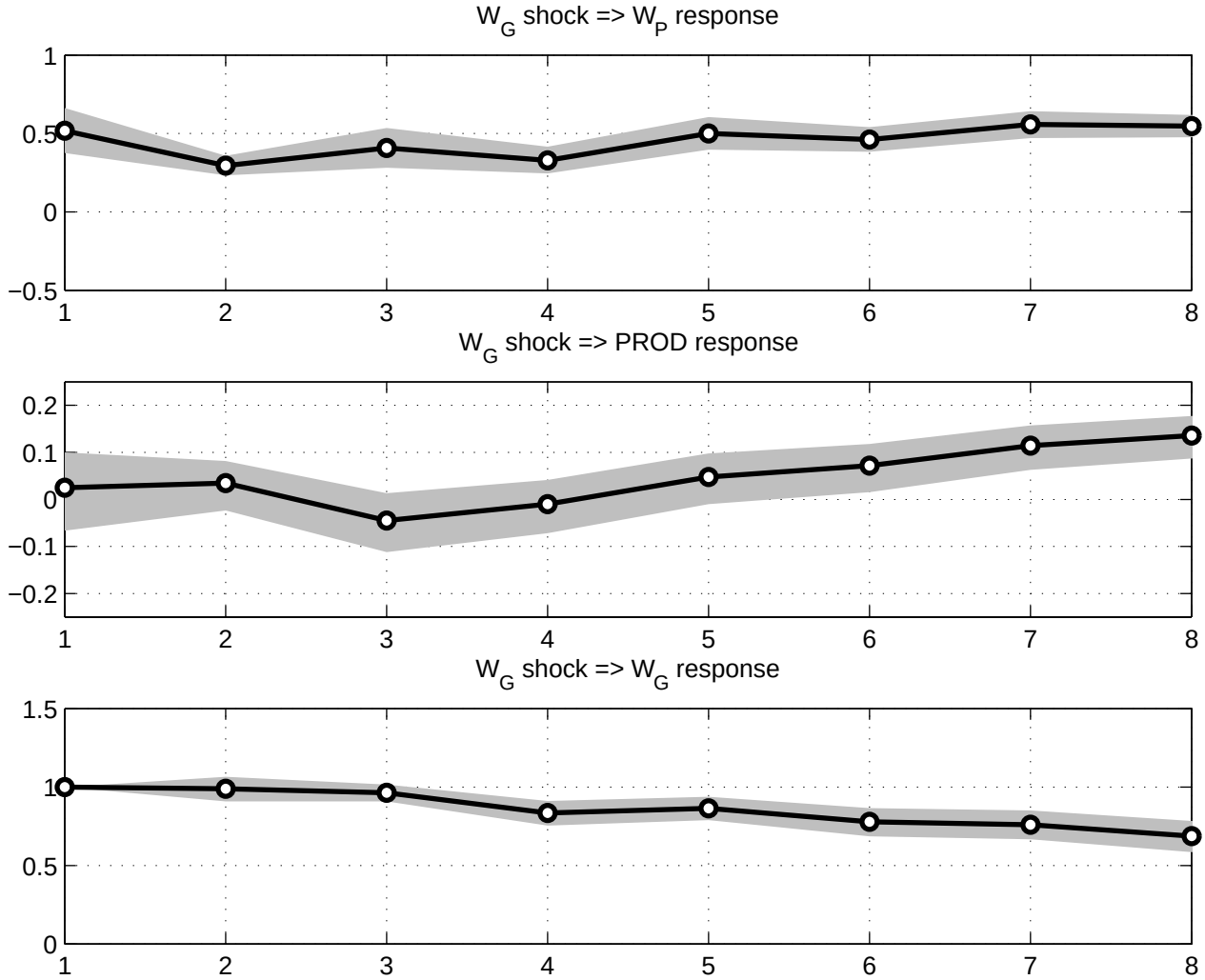
Figure 11: The effect of public employment shocks on private sector wages. Euro area aggregate. Impulse response functions to a public employment shock across regimes (recession/expansion). Smooth Transition VAR.



NOTE: The figures show the state-dependent responses to a 1% shock using the STVAR method. Response in "recession": red, dashed line.

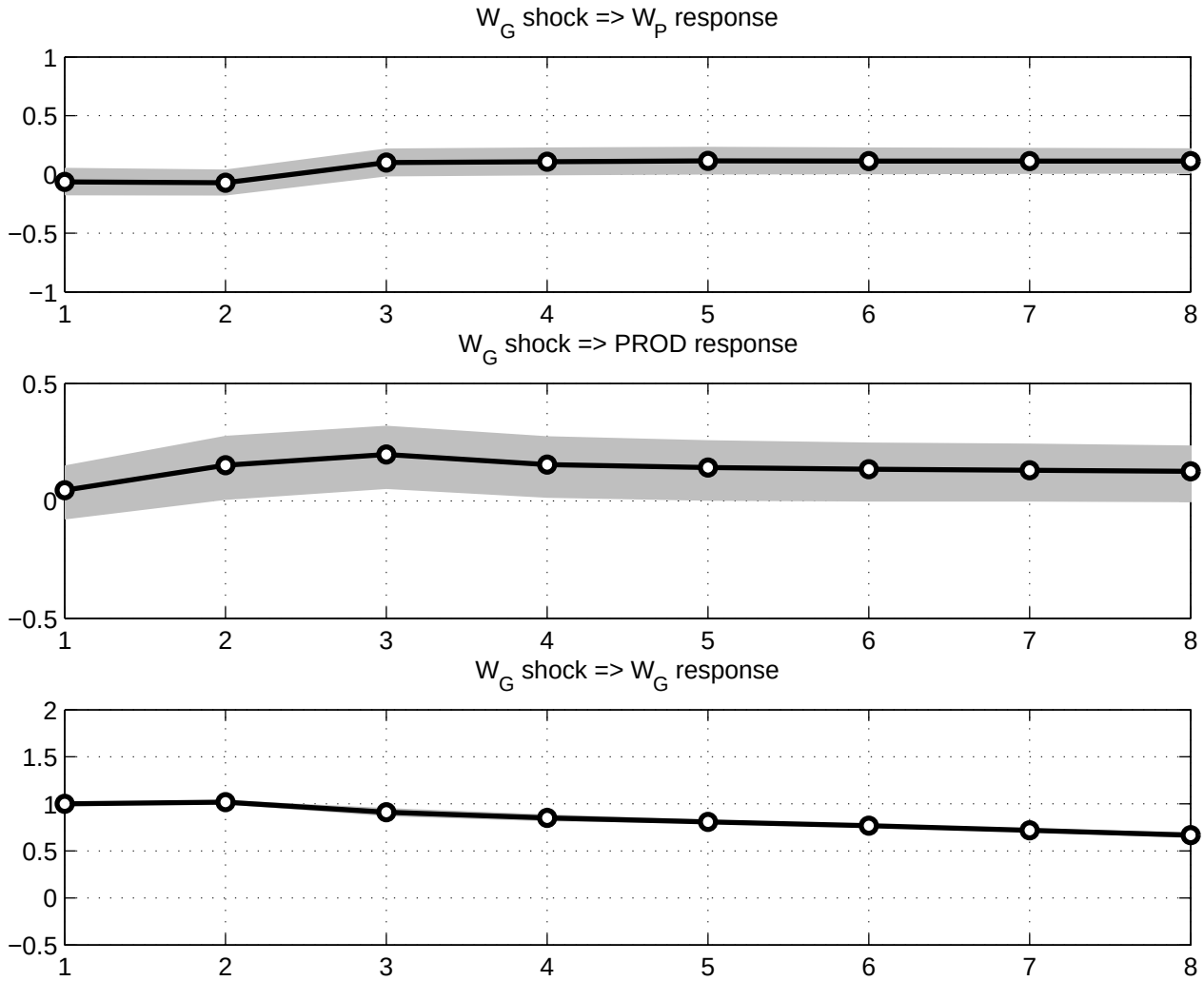
Response in "expansion": blue dotted line. Grey areas are 95% confidence bands.

Figure 12: Spain. Impulse response functions to a public wages shock: standard SVAR linear response.



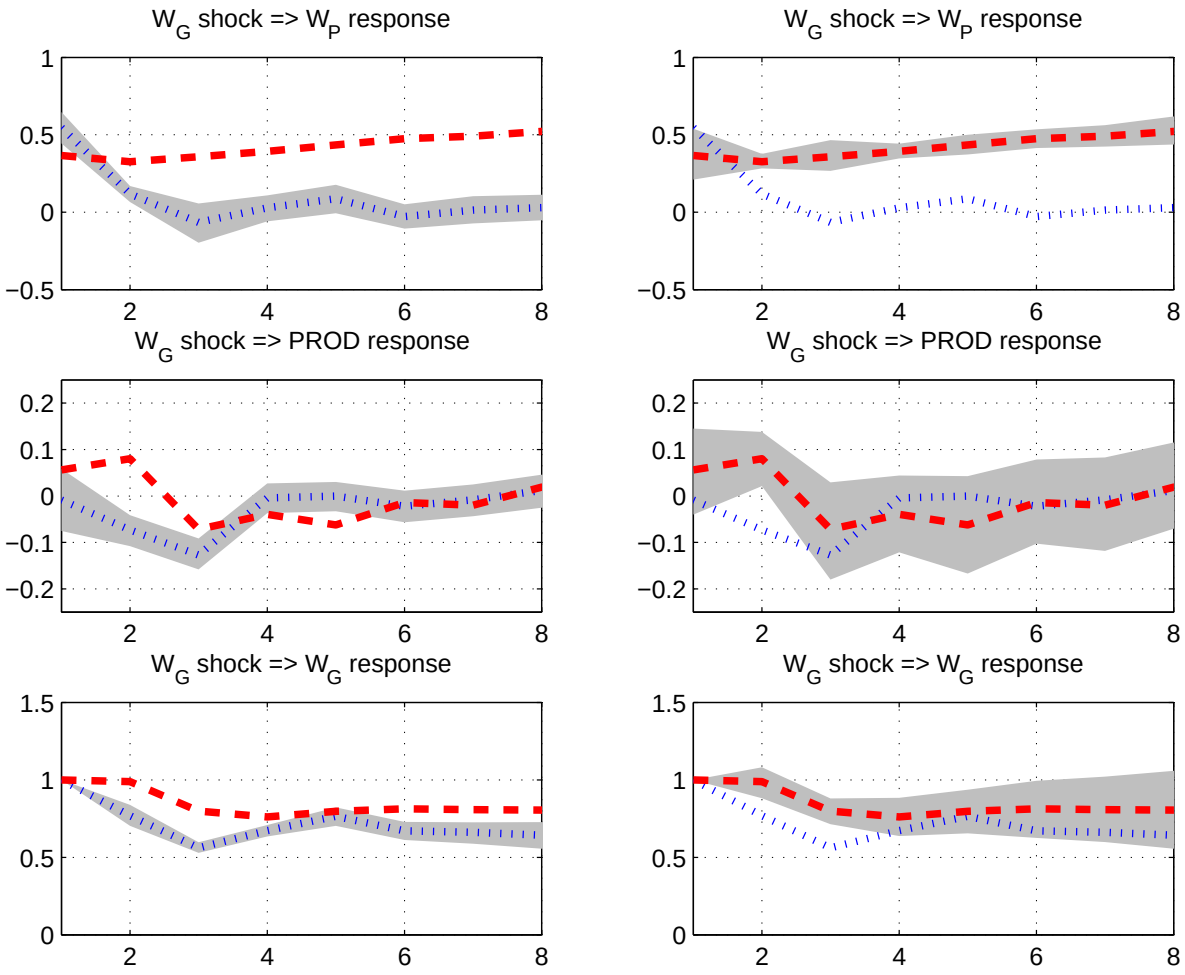
NOTE: The figures show the state-dependent responses to a 1% shock using the SVAR method. Grey areas are 95% confidence bands.

Figure 13: Euro area. Impulse response functions to a public wages shock: standard SVAR linear response.



NOTE: The figures show the state-dependent responses to a 1% shock using the SVAR method. Grey areas are 95% confidence bands.

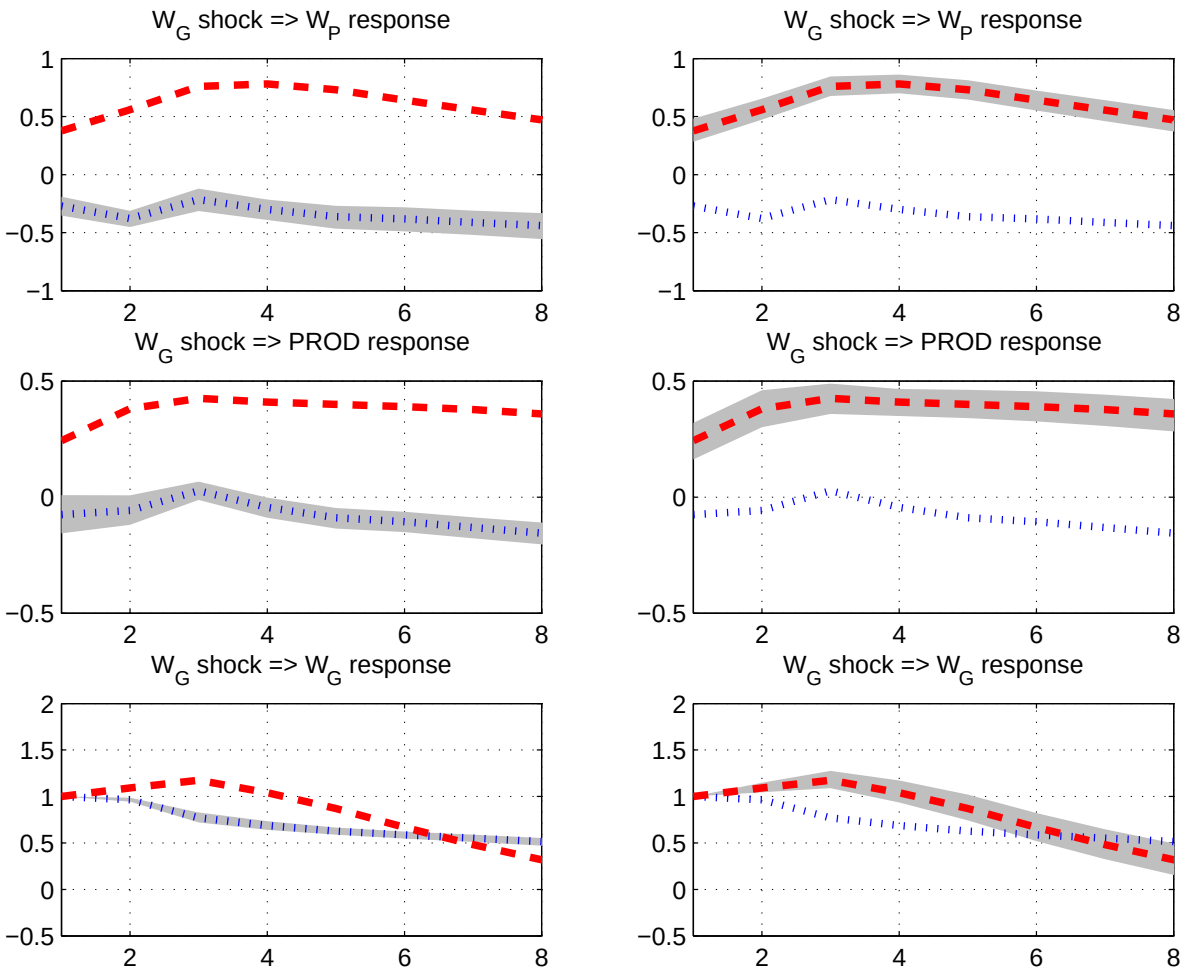
Figure 14: Spain. Impulse response functions to a public wages' shock across regimes (recession/expansion). Smooth Transition VAR.



NOTE: The figures show the state-dependent responses to a 1% shock using the STVAR method. Response in "recession": red, dashed line.

Response in "expansion": blue dotted line. Grey areas are 95% confidence bands.

Figure 15: Euro area aggregate. Impulse response functions to a public wages' shock across regimes (recession/expansion). Smooth Transition VAR.



NOTE: The figures show the state-dependent responses to a 1% shock using the STVAR method. Response in "recession": red, dashed line.

Response in "expansion": blue dotted line. Grey areas are 95% confidence bands.

Table 1: Public Employment Multipliers

Panel A: Spain

Regime	Impact	4q	8q
Recession	-0.50	2.45	3.15
	(0.77)	(0.92)	(0.88)
Expansion	-0.62	-0.36	0.03
	(0.63)	(0.79)	(0.80)
Linear	-0.62	0.48	1.92
	(0.87)	(1.67)	(2.45)

Panel B: Euro Area

Regime	Impact	4q	8q
Recession	0.43	0.04	0.06
	(1.99)	(1.26)	(1.01)
Expansion	-0.16	-0.57	-0.59
	(1.36)	(0.75)	(0.56)
Linear	0.91	0.16	0.06
	(1.62)	(1.28)	(0.97)

Notes: Standard errors in parentheses.

Table 2: Public Wages Multipliers

Panel A: Spain

Regime	Impact	4q	8q
Recession	0.36	0.39	0.52
	(0.10)	(0.03)	(0.06)
Expansion	0.54	0.03	0.03
	(0.06)	(0.04)	(0.05)
Linear	0.51	0.41	0.52
	(0.08)	(0.07)	(0.06)

Panel B: Euro Area

Regime	Impact	4q	8q
Recession	0.38	0.78	0.47
	(0.06)	(0.05)	(0.06)
Expansion	-0.27	-0.29	-0.43
	(0.05)	(0.04)	(0.07)
Linear	-0.06	0.11	0.11
	(0.07)	(0.07)	(0.06)

Notes: Standard errors in parentheses.

This document has been prepared for the workshop "Government wage bill: determinants, interactions and effects", organised by the Directorate-General for Economic and Financial Affairs of the European Commission on 11 December 2013 in Brussels.

This document exists in English only and can be downloaded from http://ec.europa.eu/economy_finance/events/2013/20131211_ecfin_workshop/index_en.htm.

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